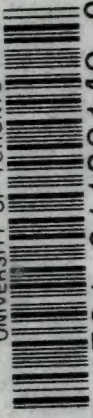


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U. S. COAST AND GEODETIC SURVEY

E. LESTER JONES, SUPERINTENDENT

TERRESTRIAL MAGNETISM

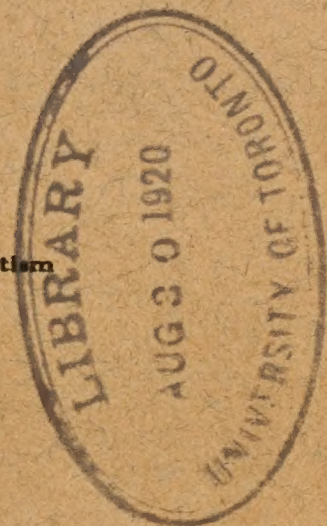
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IN 1919

By

DANIEL L. HAZARD

Assistant Chief, Division of Terrestrial Magnetism

Special Publication No. 64

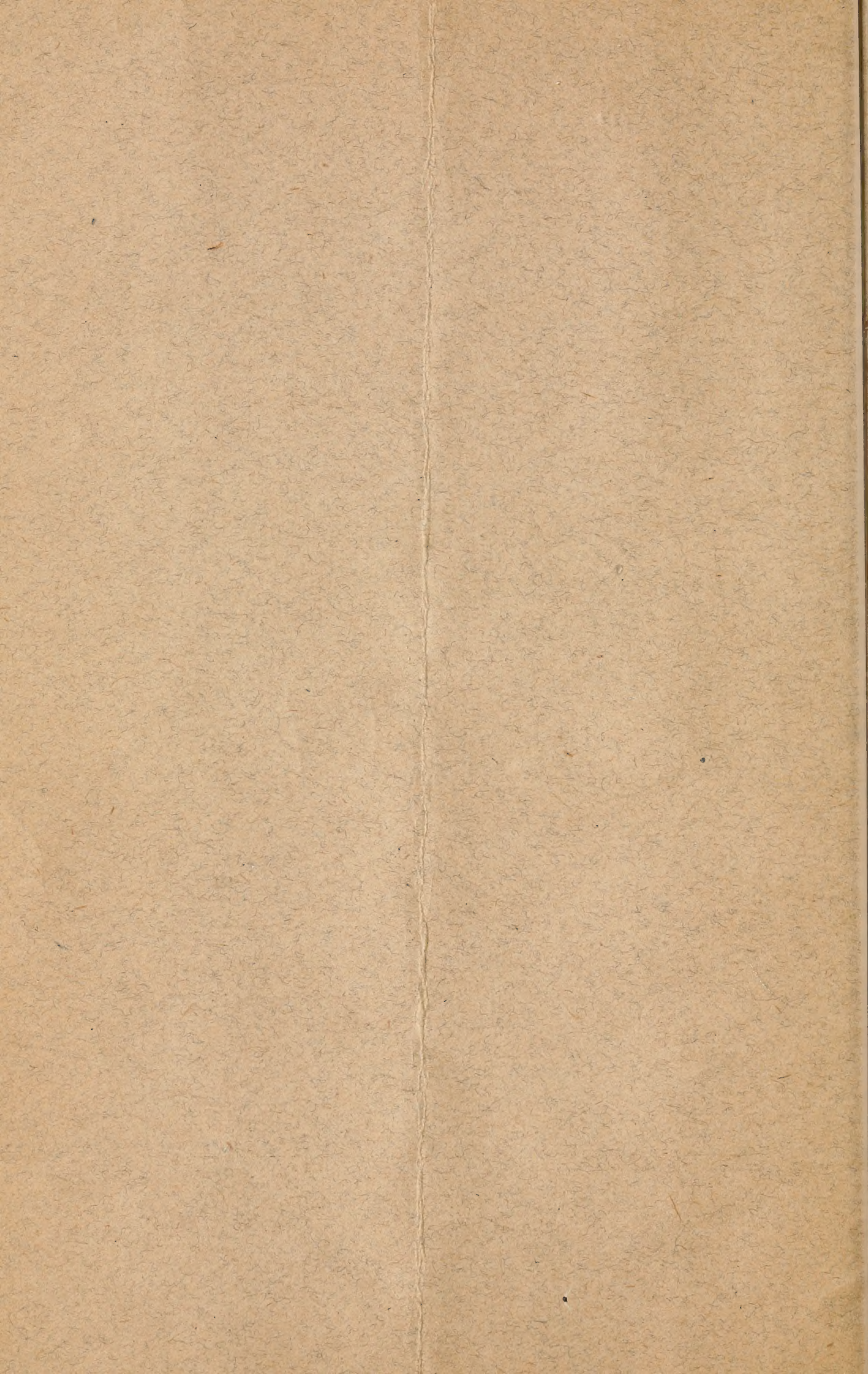


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E. LESTER JONES, SUPERINTENDENT

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TERRESTRIAL MAGNETISM

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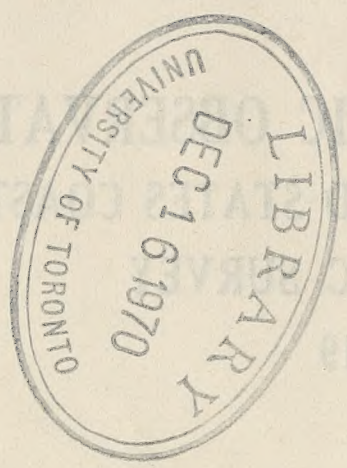
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A LETTER FROM THE DIRECTOR

TERRESTRIAL MAGNETISM

RESULTS OF MAGNETIC OBSERVATIONS  
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IN 1879



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DEPARTMENT OF COMMERCE

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# RESULTS OF MAGNETIC OBSERVATIONS MADE BY THE U. S. COAST AND GEODETIC SURVEY IN 1919.

By DANIEL L. HAZARD, *Assistant Chief, Division of Terrestrial Magnetism.*

## INTRODUCTION.

In 1882 the results of magnetic observations made by this Bureau prior to 1881, together with descriptions of stations, were published as Appendix 9, Report for 1881. From that time to 1902 the results were published only in connection with a discussion of the distribution or secular change of one or more of the three magnetic elements. In Magnetic Declination Tables and Isogonic Charts for 1902 the declination results were given for all the stations occupied up to that time and descriptions were given of the stations occupied subsequent to 1881. From 1903 to 1911 there was published annually an appendix to the Superintendent's report giving the results of magnetic observations made during the fiscal year (July to June) covered by the report.

When in 1912 it was decided to confine the annual report of the Superintendent to administrative matters and to publish separately the scientific results which had formerly appeared as appendixes to the report, the time was deemed opportune to change from the *fiscal* year to the *calendar* year in the publication of the results of magnetic observations in the field. Accordingly Special Publication No. 15 contained the results of observations made between July 1, 1911, and December 31, 1912, and the results for subsequent calendar years have appeared in Special Publications Nos. 20, 25, 36, 42, 51, and 55.

Five magnetic observatories have continued in operation throughout the year: At Cheltenham, Md.; Sitka, Alaska; near Honolulu, Hawaii; on Vieques Island, P. R.; and near Tucson, Ariz. Their records have furnished the means for reducing to mean of day the values of declination obtained from the field observations. There will be found in the tables the mean values of the magnetic elements for each of the observatories for the year 1919.

## DISTRIBUTION OF STATIONS.

The distribution of the stations is shown in the following table, from which it will be seen that observations were made in 21 States and 2 Territories. The occupation of "repeat" stations for the determination of secular change was the most important feature of the year's work. The observations in California were in the vicinity of San Francisco Bay in connection with the establishment of ranges for the use of navigators in determining the errors of ships' compasses.

*Summary of results.*

State.	Localities.	Stations.	Old localities re-occupied.	Declination results.	Dip results.	Intensity results.
Alabama.....	2	2	2	2	2	2
Alaska.....	2	2	1	2	1	1
Arizona.....	1	1	1	4	2	4
California.....	1	12	1	12	0	1
Connecticut.....	1	1	1	1	1	1
Hawaii.....	1	1	1	1	1	1
Illinois.....	1	1	1	1	1	1
Indiana.....	1	1	1	1	1	1
Kentucky.....	1	1	1	1	1	1
Maine.....	5	6	3	6	6	6
Maryland.....	2	2	2	2	2	2
Massachusetts.....	2	2	2	2	2	2
Michigan.....	2	2	2	2	2	2
Mississippi.....	3	3	2	3	3	3
New Hampshire.....	7	7	1	7	7	7
New Jersey.....	1	1	1	1	1	1
New York.....	10	10	6	10	10	10
Ohio.....	2	2	2	2	2	2
Pennsylvania.....	2	2	2	2	2	2
Porto Rico.....	1	1	1	1	1	1
Rhode Island.....	2	2	2	2	2	2
Tennessee.....	1	1	1	1	1	1
Vermont.....	6	6	3	6	6	6
West Virginia.....	3	3	1	3	3	3
Total.....	60	72	41	75	60	63

## SECULAR CHANGE OF THE MAGNETIC DECLINATION.

A comparison of the declination results at "repeat" stations occupied during the year with the results of earlier observations in the same localities is presented in the following table. The letter after the name of the station indicates (*a*) that the old station was reoccupied exactly and (*b*) that the new station was very near the old one. A tabular value of the annual change refers approximately to the middle of the period from which it was derived. A plus sign indicates increasing east declination or decreasing west declination; a minus sign, the reverse.

Most of the repeat stations occupied were in the northeastern part of the country and the results show a marked falling off in the rate of increase of west declination. In New England, where the annual increase was about 6' between 1910 and 1915, it appears to be less than 4' at the present time. At the magnetic observatory at Cheltenham, Md., the annual increase was 4'.6 between 1910 and 1915

and only 2'.4 in the past three years. At the Porto Rico magnetic observatory the annual change has fallen from 10' to 7' in the same time.

*Comparison of declination results at repeat stations.*

State and station.	Former observations.		Last observations.		Average annual change.
	Date.	Declination.	Date.	Declination.	
<b>Maine:</b>		° ' "		° ' "	' "
Eastport (a).....	1916, Je.....	20 33.3 W..	1919, Au.....	20 44.6 W..	-3.6
Bangor (a).....	1914, Au.....	18 16.6 W..	1919, Au.....	18 36.1 W..	-3.9
Portland (a).....	1914, Au.....	15 47.2 W..	1919, Au.....	16 03.4 W..	-3.2
New Hampshire: Hanover (a).....	1916, Jy.....	13 50.6 W..	1919, Se.....	14 02.9 W..	-3.9
<b>Vermont:</b>					
St. Johnsbury (a).....	1914, Jy.....	14 38.4 W..	1919, Au.....	14 55.0 W..	-3.3
Burlington (a).....	1914, Jy.....	13 38.7 W..	1919, Jy.....	13 58.1 W..	-3.9
Rutland (a).....	1913, Au.....	13 10.1 W..	1919, Jy.....	13 39.2 W..	-4.9
<b>Massachusetts:</b>					
Newburyport (a).....	1916, Je.....	14 24.3 W..	1919, Se.....	14 38.8 W..	-4.5
Worcester (a).....	1913, Jy.....	13 00.6 W..	1919, Se.....	13 24.1 W..	-3.9
<b>Rhode Island:</b>					
Providence (a).....	1916, My.....	13 14.4 W..	1919, Se.....	13 29.9 W..	-4.7
Kingston (a).....	1916, Ap.....	12 41.8 W..	1919, Se.....	13 02.1 W..	-6.0
<b>New York:</b>					
Greenport (a).....	1914, Oc.....	11 22.8 W..	1919, Oc.....	11 44.1 W..	-4.3
Albany (a).....	1915, Oc.....	12 07.6 W..	1919, Jy.....	12 19.9 W..	-3.3
Utica (b).....	1912, Je.....	10 51.8 W..	1919, Jy.....	11 25.3 W..	-4.7
Ithaca (a).....	1916, Au.....	8 21.6 W..	1919, Jy.....	8 29.0 W..	-2.6
Rochester (a).....	1915, Oc.....	8 08.4 W..	1919, Jy.....	8 19.8 W..	-3.0
Buffalo (a).....	1915, Oc.....	7 02.7 W..	1919, Jy.....	7 13.8 W..	-3.0
New Jersey: Trenton (a).....	1914, Je.....	8 55.7 W..	1919, Oc.....	9 19.4 W..	-4.5
<b>Pennsylvania:</b>					
Easton (a).....	1914, Jy.....	8 01.8 W..	1919, Oc.....	8 28.5 W..	-5.1
Harrisburg (b).....	1914, Au.....	7 21.9 W..	1919, Oc.....	7 38.0 W..	-3.1
<b>Maryland: Cheltenham Observa-</b>					
<b>tory (a).....</b>	1917, year.....	6 10.3 W..	1919, year.....	6 15.0 W..	-2.4
<b>West Virginia: Parkersburg (a).....</b>	1916, Ap.....	2 02.2 W..	1919, No.....	2 07.6 W..	-1.5
<b>Michigan:</b>					
Detroit (a).....	1915, Oc.....	1 55.1 W..	1919, Jy.....	2 02.0 W..	-1.9
Kalamazoo (a).....	1913, Jy.....	1 05.4 E..	1919, Je.....	0 55.4 E..	-1.7
<b>Ohio: Cincinnati (a).....</b>	1916, Ap.....	1 00.0 E..	1919, No.....	0 54.8 E..	-1.4
<b>Indiana: New Albany (a).....</b>	1915, Oc.....	1 37.8 E..	1919, No.....	1 34.9 E..	-0.7
<b>Illinois: Urbana (a).....</b>	1917, Je.....	3 13.2 E..	1919, Je.....	3 14.6 E..	+0.7
<b>Kentucky: Bowling Green (a).....</b>	1909, Jy.....	5 00.9 E..	1919, No.....	5 03.5 E..	+0.2
<b>Tennessee: Nashville (a).....</b>	1915, Je.....	3 35.0 E..	1919, De.....	3 32.8 E..	-0.5
<b>Alabama:</b>					
Florence (a).....	1915, My.....	3 57.8 E..	1919, De.....	4 00.3 E..	+0.6
Tuscaloosa (a).....	1915, Mh.....	4 31.2 E..	1919, De.....	4 37.1 E..	+1.2
<b>Mississippi:</b>					
Meridian (a).....	1915, Ap.....	5 01.6 E..	1919, De.....	5 08.0 E..	+1.4
Jackson (a).....	1915, My.....	6 18.6 E..	1919, De.....	6 29.2 E..	+2.3
<b>Arizona: Tucson Observatory (a).....</b>	1917, year.....	13 46.1 E..	1919, year.....	13 47.8 E..	+0.9
<b>California: Goat Island (b).....</b>	1916, Au.....	18 18.0 E..	1919, Oc.....	18 23.0 E..	+1.6
<b>Alaska: Sitka Observatory (a).....</b>	1917, year.....	30 25.0 E..	1919, year.....	30 26.9 E..	+1.0
<b>Hawaii: Honolulu Observatory (a).....</b>	1917, year.....	9 46.3 E..	1919, year.....	9 50.7 E..	+2.2
<b>Porto Rico: Vieques Observatory (a).....</b>	1917, year.....	3 26.9 W..	1919, year.....	3 40.0 W..	-6.5

INSTRUMENTAL CORRECTIONS.

The instruments used in the field work have been compared with the observatory instruments at the end of the year, the results in general differing but little from those obtained at the end of 1918.

Beginning with 1913 the results of horizontal intensity observations made by the Coast and Geodetic Survey have been reduced to the international standard of the department of terrestrial magnetism of the Carnegie Institution of Washington. The published results of horizontal intensity determinations made before that year must be diminished by 0.001 H to reduce them to that standard.

The instrumental corrections indicated in the tables below have been applied.

*Corrections to magnetometers.*

Number.	Pattern.	Correction to east declination.	Correction to H in parts of H.
17	Coast and Geodetic Survey.....	0.0	0.0000
19	do.....	.0	-.0008
26	Wild-Edelmann.....	.0	-.0010
30	India Survey.....	.0	.0000
31	do.....	.0	-.0007
36	do.....	-.4	.0000
37	do.....	.0	+.0016
40	do.....	.0	.0000

*Corrections to dip circles.*

Number.	Pattern.	Needles.	Corrections.
56	Kew-Casella.....	1	+1.6
		<sup>a</sup> 3	-2.0
5678	Kew-Casella.....	1	-2.6
		2	-2.6

<sup>a</sup> This needle was originally used with dip circle No. 18.

DIURNAL VARIATION CORRECTION.

Each value of the magnetic declination has been corrected for diurnal variation with the aid of the continuous observations at the nearest magnetic observatory, allowance being made for the change in diurnal range with change in magnetic latitude. No attempt has been made to correct the dip and intensity results for diurnal variation.

ARRANGEMENT OF TABLE.

The results presented are arranged by States alphabetically, and the results for each State are given in the order of increasing latitudes. The latitudes and longitudes are in most cases the results of solar observations made with the small theodolite which forms a part of the magnetometer. In default of observations, a chart, or topographic sheet of the United States Geological Survey, the geographic coordinates were scaled from the best available map, usually a post-route map. In such cases only the nearest whole minute of latitude or longitude is given. The horizontal intensity is expressed in terms of the one hundred-thousandth part of a C. G. S. unit of intensity of magnetic force, termed a "gamma," and designated by the Greek letter  $\gamma$ .

In order to include the desired amount of information in the available space, the months have been abbreviated as follows:

January	Ja.	May	My.	September	Se.
February	Fe.	June	Je.	October	Oc.
March	Mh.	July	Jy.	November	No.
April	Ap.	August	Au.	December	De.

The numbers shown as a decimal in the column headed "D. C." give the needles used. Dip circle 5678 is designated as 78 in the tabulation in order to conserve space.

The observer is indicated by the initials of his name. The names of the observers are as follows:

W. H. Cullum.	P. V. Lane.	F. Neumann.
J. W. Green.	H. E. McComb.	L. P. Raynor.
G. Hartnell.	W. W. Merrymon.	F. P. Ulrich.
W. M. Hill.		

*Magnetic observations on land.*

ALABAMA.

Station.	Latitude.	Longitude.	Date.	Declination.	Dip.	Horizontal intensity.	Instruments.		Observer.
							M.	D. C.	
Tuscaloosa.....	33 12.4	87 32.7	De. 11	<i>East.</i> 4 37.1	65 09.3	23754	19	56.13	W. W. M.
Florence.....	34 49.6	87 41.1	De. 6.	4 00.3	66 43.4	22508	19	56.13	W. W. M.

ALASKA.

Sitka Observatory...	57 03.0	135 20.1	Year	30 26.9	74 23.6	15571	37	2 EI	F. P. U.
Karluk.....	57 34.2	154 31.0	Se. 6	23 21.6	.. .. .	.....	8	.....	P. V. L.

ARIZONA.

Tucson Observatory..	32 14.8	110 50.1	Year	13 47.8	59 27.7	26919	30	3 EI	W. H. C.
Do.....	32 14.8	110 50.1	Fe.-Mh.	13 47.6	59 27.5	26920	17	78.12	W. H. C.
Do.....	32 14.8	110 50.1	My.-Je.	13 47.4	.. .. .	26922	40	.....	W. H. C.
Do.....	32 14.8	110 50.1	Au. 26, 27	13 47.9	.. .. .	26893	40	.....	J. W. G.

CALIFORNIA.

Hunters Point.....	37 43.6	122 22.0	No. 11	18 51.8	.. .. .	.....	40	.....	H. E. M.
Bay Farm Island.....	37 44.3	122 15.1	No. 10	18 15.6	.. .. .	.....	4	.....	H. E. M.
Point Lobos.....	37 47.0	122 30.6	No. 10	18 18.0	.. .. .	.....	4	.....	H. E. M.
North Point.....	37 48.4	122 25.3	No. 8	21 56.3*	.. .. .	.....	4	.....	H. E. M.
Goat Island.....	37 48.9	122 21.5	Oc.-No.	18 23.0	.. .. .	24931	40	.....	H. E. M.
Goat Island aux.....	37 48.9	122 21.5	Oc.-No.	18 23.9	.. .. .	.....	4	.....	L. P. R.
Point Bonita.....	37 49.0	122 31.7	No. 7	18 03.6	.. .. .	.....	4	.....	H. E. M.
Alcatraz Island.....	37 49.6	122 25.3	No. 5	18 14.9	.. .. .	.....	4	.....	H. E. M.
Fort Baker.....	37 49.7	122 28.8	No. 7	15 44.6*	.. .. .	.....	4	.....	H. E. M.
Sausalito.....	37 50.8	122 29.0	No. 8	18 02.5	.. .. .	.....	4	.....	H. E. M.
Angel Island.....	37 51.7	122 26.7	No. 6	18 41.3	.. .. .	.....	4	.....	H. E. M.
Red Rock.....	37 55.8	122 25.8	No. 12	18 22.0	.. .. .	.....	4	.....	H. E. M.

CONNECTICUT.

New London.....	41 21.0	72 06.7	Se. 30	<i>West.</i> 11 58.0	72 45.8	17392	19	56.13	W. W. M.
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\* Artificial local disturbance.

## Magnetic observations on land—Continued.

## HAWAII.

Station.	Latitude.	Longitude.	Date.	Declination.	Dip.	Horizontal intensity.	Instruments.		Observer.
							M.	D. C.	
Honolulu Obs'y.....	21 19.2	158 03.8	Year	<i>East.</i> 9 50.7	39 26.5	28858	36	4 EI	F. N.

## ILLINOIS.

Urbana.....	40 05.9	88 13.9	Je. 26	3 14.6	71 09.5	19337	19	56.13	W. W. M.
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## INDIANA.

New Albany.....	38 19	85 48.6	No. 22	1 34.9	70 42.1	19488	19	56.13	W. W. M.
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## KENTUCKY.

Bowling Green.....	36 59.7	86 26.2	No. 28	5 03.5	68 37.5	21382	19	56.13	W. W. M.
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## MAINE.

	Latitude.	Longitude.	Date.	Declination.	Dip.	Horizontal intensity.	M.	D. C.	Observer.
Portland, old.....	43 38.8	70 16.6	Au. 16	<i>West.</i> 16 03.4	74 04.4	16168	19	56.13	W. W. M.
Portland, new.....	43 40.9	70 18.3	Au. 18	15 56.4	74 02.3	16193	19	56.13	W. W. M.
Hiram.....	43 52.9	70 47.8	Au. 12	16 03.4	74 12.5	16020	19	56.13	W. W. M.
Harrison.....	44 06.6	70 40.0	Au. 13	16 40.6	74 35.2	15646	19	56.13	W. W. M.
Bangor.....	44 48.2	68 48.2	Au. 24	18 36.1	74 43.6	15415	19	56.13	W. W. M.
Eastport.....	44 54.9	66 59.7	Au. 21	20 44.6	74 15.6	15911	19	56.13	W. W. M.

## MARYLAND.

Cheltenham Obs'y...	38 44.0	76 50.5	Year	6 15.0	70 55.5	19161	26	26 EI	G. H.
Oakland.....	39 24.5	79 25.3	No. 6	4 47.9	71 08.8	18889	19	56.13	W. W. M.

## MASSACHUSETTS.

Worcester.....	42 16.7	71 48.5	Se. 24	13 24.1	73 20.3	16784	19	56.13	W. W. M.
Newburyport.....	42 47.3	70 48.6	Se. 4	14 38.8	73 37.3	16456	19	56.13	W. W. M.

## MICHIGAN.

Kalamazoo.....	42 17.5	85 37.0	Je. 30	<i>East.</i> 0 55.4	73 22.6	17393	19	56.13	W. W. M.
Detroit.....	42 20.4	82 57.6	Jy. 2	<i>West.</i> 2 02.0	73 21.4	17215	19	56.13	W. W. M.

## MISSISSIPPI.

Wiggins.....	30 52.0	89 07.0	De. 20	<i>East.</i> 5 28.0	62 17.6	25505	19	56.13	W. W. M.
Jackson.....	32 20.0	90 10.9	De. 18	6 29.2	64 09.8	24328	19	56.13	W. W. M.
Meridian.....	32 22.3	88 43.8	De. 15	5 08.0	63 51.8	24592	19	56.13	W. W. M.

## NEW HAMPSHIRE.

Windham Depot....	42 50.3	71 17.9	Se. 8	<i>West.</i> 14 06.4	73 37.2	16461	19	56.13	W. W. M.
Hillsboro.....	43 07.2	71 53.1	Se. 20	13 58.7	73 54.6	16276	19	56.13	W. W. M.
Contocook.....	43 13.8	71 43.0	Se. 19	13 46.4	74 00.3	16317	19	56.13	W. W. M.
Bradford.....	43 16.0	71 58.6	Se. 18	14 15.0	73 58.2	16241	19	56.13	W. W. M.
Claremont Junction.	43 22.2	72 22.6	Se. 16	14 05.4	73 50.4	16430	19	56.13	W. W. M.
Danbury.....	43 31.2	71 51.6	Se. 10, 12	14 27.4	74 04.5	16142	19	56.13	W. W. M.
Hanover.....	43 43.0	72 16.8	Se. 13	14 02.9	74 25.0	15918	19	56.13	W. W. M.

*Magnetic observations on land—Continued.*

## NEW JERSEY.

Station.	Latitude.	Longitude.	Date.	Declination.	Dip.	Horizontal intensity.	Instruments.		Observer.
							M.	D. C.	
Trenton.....	40 15.1	74 48.5	Oct. 25	<i>West.</i> 9 19.4	71 44.0	18336	19	56.13	W. W. M.

## NEW YORK.

Jamaica.....	40 41.9	73 51.5	Oct. 18	10 04.1	72 23.4	17816	19	56.13	W. W. M.
Mineola.....	40 44.1	73 38.0	Oct. 13	10 35.1	72 16.0	17750	19	56.13	W. W. M.
Riverhead.....	40 55.4	72 40.3	Oct. 9	11 19.3	72 27.4	17645	19	56.13	W. W. M.
Greenport.....	41 06.3	72 21.7	Oct. 8	11 44.1	72 18.4	17777	19	56.13	W. W. M.
Ithaca.....	42 27	76 28.0	Jy. 14	8 29.0	73 48.0	16498	19	56.13	W. W. M.
Norwich.....	42 31.2	75 31.5	Jy. 17	10 33.8	73 44.6	16596	19	56.13	W. W. M.
Albany.....	42 40.5	73 45.0	Jy. 25	12 19.9	73 49.8	16449	19	56.13	W. W. M.
Buffalo.....	42 54.6	78 54.0	Jy. 5	7 13.8	74 00.4	16555	19	56.13	W. W. M.
Utica.....	43 05.2	75 15.1	Jy. 23	11 25.3	74 03.8	16374	19	56.13	W. W. M.
Rochester.....	43 07.9	77 36.0	Jy. 11	8 19.8	74 10.0	16351	19	56.13	W. W. M.

## OHIO.

Cincinnati.....	39 08.2	84 31.0	No. 20	<i>East.</i> 0 54.8	70 51.3	19420	19	56.13	W. W. M.
McConnellsville.....	39 39.4	81 51.3	No. 14	<i>West.</i> 1 51.8	71 34.0	18732	19	56.13	W. W. M.

## PENNSYLVANIA.

Harrisburg.....	40 15.4	76 53.0	Oct. 29	7 38.0	72 06.0	18121	19	56.13	W. W. M.
Easton.....	40 42.2	75 12.1	Oct. 21	8 28.5	72 09.4	18053	19	56.13	W. W. M.

## PORTO RICO.

Porto Rico Observatory.....	18 08.8	65 26.9	Year.	3 40.0	51 18.3	27896	31	1EI	W. M. H.
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## RHODE ISLAND.

Kingston.....	41 28.8	71 31.4	Se. 27	13 02.1	72 52.0	17173	19	56.13	W. W. M.
Providence.....	41 45.5	71 27.9	Se. 26	13 29.9	72 58.2	17033	19	56.13	W. W. M.

## TENNESSEE.

Nashville.....	36 08.3	86 45.1	De. 1	<i>East.</i> 3 32.8	67 42.0	21816	19	56.13	W. W. M.
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## VERMONT.

Rutland.....	43 37.1	72 57.7	Jy. 28	<i>West.</i> 13 39.2	74 10.8	16144	19	56.13	W. W. M.
St. Johnsbury.....	44 24.6	72 00.0	Au. 7	14 55.0	74 47.0	15526	19	56.13	W. W. M.
Burlington.....	44 28.5	73 11.7	Jy. 30	13 58.1	74 34.0	15841	19	56.13	W. W. M.
Hardwick.....	44 30.1	72 22.7	Au. 5	15 36.8	74 40.6	15673	19	56.13	W. W. M.
West Burke.....	44 38.7	71 58.7	Au. 8	15 19.8	74 53.3	15416	19	56.13	W. W. M.
Cambridge Junction.....	44 39.0	72 49.3	Au. 4	15 43.1	75 09.4	15580	19	56.13	W. W. M.

## WEST VIRGINIA.

Parkersburg.....	39 16.1	81 33.6	No. 8	2 07.6	71 10.3	19133	19	56.13	W. W. M.
Middlebourne.....	39 29.5	80 54.4	No. 11, 12	1 48.6	71 14.4	18965	19	56.13	W. W. M.
Berkeley Springs.....	39 37.0	78 13.7	Oct. 31	5 34.8	71 24.3	18714	19	56.13	W. W. M.

## DESCRIPTIONS OF STATIONS.

Magnetic observers are instructed to mark each station (except auxiliary stations for development of local disturbance) in as permanent a manner as possible, either with a stone, a draintile filled with cement, or a post of some durable wood, so that it may be available for future occupation. They are also required to furnish a sufficiently detailed description to locate the station, even if the marking should be destroyed, and to determine the bearings of two or three prominent objects in addition to the one used as a reference mark in the azimuth and declination observations. The information is given in abridged form on the following pages. Further details can usually be obtained upon application to the Superintendent of the Coast and Geodetic Survey.

The usual method of marking a station is by a stone post about 30 inches long and 6 inches square, set so as to project 2 or 3 inches above the ground. In the center of the top is set a circular bronze plate  $3\frac{1}{2}$  inches in diameter.

When the local authorities desire it, and are willing to bear the expense, a second stone is set to mark the true meridian.

The descriptions of stations are arranged alphabetically by States and by names of stations.

## ALABAMA.

*Florence, Lauderdale County.*—The station of 1915 was reoccupied. It is in the southeast corner of the grounds of the old Baptist University, about 2 miles northwest of the town's center, near the city water tank. It is 78 feet southwest from the fence bordering the grounds on the northeast, 115.3 feet from the fence bordering the grounds on the southeast, 171 feet from the eastern corner of the ruined wall of the university building, and 71 feet northeast from the north corner of a small frame house. The station is marked by a limestone post 6 by 6 by 33 inches projecting 6 inches above the ground and lettered U. S. C. & G. S., 1909. The following true bearings were determined in 1909 and 1919:

Eastern edge of abutment of city water tank, near base.....	40	25.2	W. of N.
Center of base of telephone pole 250 feet away .....	23	22.3	W. of S.
Outer corner of lower capstone of abutment on west side of city water tank.....	46	08.0	W. of N.

*Tuscaloosa, Tuscaloosa County.*—The station of 1915 was reoccupied. It is on the grounds of the State University, 227.4 feet and 166.3 feet, respectively, from the southeast and northeast corners of Garland Hall, 180.7 feet from the southeast corner of the boys' dormitory, 63 feet south-southeast of a large cedar tree, 73 feet north-northeast of another cedar tree, and about 23 feet west-northwest of a small tree. The station is marked by a limestone post, 5 by 6 by 30 inches, set 28 inches in the ground, and lettered U. S. C. & G. S., 1905. The following true bearings were determined in 1915 and 1919:

Center of right-hand-most lower window in gymnasium.....	10	41.1	W. of S.
Southeast corner of cement base to monument in driveway.....	37	16.9	W. of S.
Northeast corner of square stone set in Comer Hall, just below the lower stone border.....	76	14.3	W. of N.
Point on second cupola to left of main dome at Insane Asylum .....	55	23.4	E. of N.
Base of flagstaff on main dome at Insane Asylum.....	57	54.8	E. of N.



## CALIFORNIA.

*Alcatraz Island, San Francisco County.*—Observations were made in the southern part of the drill ground overlooking the bay.

*Angel Island, Marin County.*—Observations were made at the roadside where the road cuts through the hill at Point Stuart. The station overlooks West Garrison to the southeast.

*Bay Farm Island, Alameda County.*—Observations were made about 100 feet south of triangulation station "Bay" on the line to Oakland City Hall prolonged.

*Fort Baker, San Francisco County.*—Observations were made about 400 feet southeast of triangulation station "Hill" on the line to Progress Statue.

*Goat Island, San Francisco County.*—The old station could not be used, as the site is now covered by barracks. Observations were therefore made on the highest part of the hill at the east end of the island (now called Yerba Buena Island) at the point used as a triangulation station by the Public Works Office of the U. S. Naval Training Station. The station is about 500 feet east of the old one and is marked by a copper bolt in a concrete post which projects about 6 inches above the ground. The following true bearings were determined by triangulation:

Campanile, University of California.....	54 21.8 E. of N.
Oakland City Hall tower.....	82 46.8 E. of S.
Smokestack at Hunters Point.....	0 41.7 E. of S.
Point Bonita Lighthouse.....	89 19.0 W. of N.
Lighthouse on Alcatraz Island.....	76 11.7 W. of N.

Observations were also made at a point about 60 feet from the station in the direction of the Campanile.

*Hunters Point, San Francisco County.*—Observations were made on the first hill to the west of and about 600 feet from Point Avisadero triangulation station.

*North Point, San Francisco County.*—Observations were made on the open lot near the intersection of Beach and Larkin Streets, 300 feet southeast of the east end of the Southern Pacific Railroad bridge. It is nearer Fort Mason than North Point.

*Point Bonita, Marin County.*—Observations were made about 400 feet east of Point Bonita Lighthouse, on the same point as the lighthouse keeper's quarters.

*Point Lobos, San Francisco County.*—Observations were made on the cliff overlooking Golden Gate, at a point nearly in line with Fort Point and Point Blunt Lighthouse on Angel Island.

*Red Rock, Contra Costa County.*—Observations were made at the triangulation station on the highest point of the island. The station is marked by a bronze disk set in the top of a concrete block which is flush with the surface of the ground.

*Sausalito, Marin County.*—Observations were made on the hillside about one-half mile to the south of the center of the village. The station was about in line with the power house and Alcatraz Lighthouse.

## CONNECTICUT.

*New London, New London County.*—The old station was temporarily unsuitable for occupation, so observations were made in an adjoining pasture 125 feet due north of the old station. The old station was in a small pasture on the grounds of the almshouse, about 1 mile west of the city hall and about 600 feet west of the water tank. It is 59 feet south-southwest from the west post of the gate leading into this pasture and is in line with the northeast corner of the pasture wall and the southeast corner of the detention hospital. The pasture is about 80 by 85 feet and is full of granite boulders. The station is marked by a stone post 6 by 6 by 30 inches set flush with the ground. A similar stone was set 222.8 feet to the south to mark the true meridian.

Both stones are lettered U. S. C. S. The following true bearings were determined at the old station in 1904 and 1919:

	°	'	
Gable of frame house one-eighth mile away (mark).....	13	11.5	E. of S.
Meridian stone, center.....	0	02.0	W. of S.
Small ventilation window in large house one-eighth mile away....	9	50.0	W. of N.
Weather vane on south end of old hospital building north of road..	50	13.3	E. of N.

## ILLINOIS.

*Urbana, Champaign County.*—The station of 1907 in the Roselawn Cemetery was reoccupied. It is 130.1 feet southwest from the southwest corner of the base of the John E. Strong monument and 30.6 feet from a small birch tree west of the station next to the driveway. It is in an alley on block E, between lots 19, 20, 21, and 22, near the center of the cemetery. It is marked by a bronze disk set in a limestone post flush with the ground. The disk is marked 1917. The following true bearings were determined:

	°	'	
Tip of silo at barn on old Haines homestead ( $1\frac{1}{2}$ miles away).....	75	11.8	W. of N.
Middle (near) edge on square brick chimney at Yeates greenhouse..	24	29.7	E. of N.
Letter L in Lawhead monument.....	39	52.1	W. of S.

## INDIANA.

*New Albany, Floyd County.*—The station of 1915 was reoccupied. It is on the County Poor Farm about 2 miles north of the center of the town. Observations were made over the middle one of three meridian stones which are set about 200 yards back from the pike. The stones are 8 by 8 by 48 inches and project about 15 inches above the ground. The north stone is about 80 feet from the station and the south stone about 600 feet. The following true bearings were determined:

	°	'	
German Church spire 2 miles away (mark).....	1	54.3	E. of S.
Catholic Church spire.....	9	25.7	E. of S.
West gable of house 1,000 feet away.....	27	37.6	E. of N.
Southwest gable on two-story house one-half mile away.....	8	45.1	E. of N.
East gable of small house 1,000 feet away.....	51	02.0	W. of S.

## KENTUCKY.

*Bowling Green, Warren County.*—The station of 1909 was reoccupied. It is in the east corner of the grounds surrounding Ogden College, about three-fourths mile south of the courthouse. The station is 45.7 feet south-southwest from the front fence and 51.5 feet west-northwest from the near face of the rock wall along the southeast side of the campus. It is also about 157 feet due east from the south one of two meridian stones established on the campus in 1909 and 289 feet southeast from the north meridian stone. The station is marked by a limestone post 10 by 8 by 16 inches, with a cylindrically rounded top, on which the letters U. S. C. & G. S. and a center hole are cut. The top of the stone is about 6 inches below the surface of the ground. The following true bearings were determined in 1909 and 1919:

	°	'	
Center corner of base of right-hand-most post at northeast corner post of piazza of college.....	85	45.7	W. of N.
Near corner on rear chimney on brick house 700 feet away (mark)..	25	18.9	E. of N.
Northeast (left-hand-most) corner of John R. Drake's house, under eaves.....	65	08.6	E. of S.
Nearest brick corner on Ben Proctor's house, 250 feet away.....	29	15.8	E. of S.
Right-hand-most edge, next porch, of base border stone on college building.....	88	26.4	W. of N.

## MAINE.

*Bangor, Penobscot County.*—The station of 1905 on Thomas Hill, near the center of a vacant lot owned by Mr. Prentiss, was reoccupied. It is 76.3 feet northeast of a tree, 126.1 feet from the fence on the north side of Highland Avenue, and 133.9 feet from the fence on the west side of Gov. Davis's yard. The station is marked by a granite boulder smoothed on the top and lettered U. S. C. & G. S. The following true bearings were determined:

Spire of East Bangor church 3 miles away (mark).....	20 03.0	W. of N.
Flagpole on reservoir 400 feet away.....	24 27.4	E. of N.
Near edge of lower chimney on house.....	15 58.0	E. of S.
North edge of house 250 feet away.....	44 40.7	W. of N.

*Eastport, Washington County.*—The station of 1916 was reoccupied. It is about one-sixth mile northwest of the Eastport standpipe, in a pasture belonging to J. R. Roche. It is south of the eastern one of two prominent ledges known as the "Batteries," about 450 feet from the main road to the east, 200 feet from a fence to the south. It is just south of the rocky knoll on which the old station was located, 125 feet south of the road leading across the pasture to the baseball grounds, 114.6 feet from an iron pin in a rocky ledge to the south. A second iron pin is 118.4 feet northeast from the station in a ledge near the road. The station is marked by a bronze disk set in a cement base 14 inches square. The following true bearings were determined:

Lighthouse on Eastpoint (Canadian side) (mark).....	11 15.3	E. of S.
Spire of Unitarian Church.....	27 24.0	E. of S.
Near edge of high-school building at second story.....	77 08.6	E. of S.
Left edge of standpipe.....	72 11.0	E. of S.
Spire of Congregational Church.....	44 43.0	E. of S.

*Harrison, Cumberland County.*—Observations were made at a point on the east side of the cemetery, about two-thirds of a mile east of the railroad station and about 400 feet northeast of the Harrison Hotel. The station is in the middle of what is now a driveway, about 150 feet from the road along the north side of the cemetery and 17½ feet east-northeast of the Hy. N. Winslow monument. The station was not permanently marked. The following true bearings were determined:

Center of dormer windows on house 3 miles away (mark).....	50 31.5	W. of S.
Spire on Congregational Church.....	76 27.9	W. of N.
Northwest edge of house across street 300 feet away.....	10 29.8	E. of N.
Center of stone near southeast corner of building 700 feet away.....	58 15.4	E. of N.

*Hiram, Oxford County.*—Magnetic observations were made in the field in the rear of the school yard at a point 109 feet northwest from the northwest corner of the school building, 39 feet north by east from the north corner of the shed in the rear of the school and churchyard and 48 feet west-northwest from the girl's privy in the school yard. The school yard is about one-half mile northeast of the railroad depot at Hiram. The following true bearings were determined:

Center of chimney on house three-fourths mile away (mark).....	21 59.7	W. of N.
Flagpole on building in East Hiram.....	69 27.9	E. of N.
Tower on church in East Hiram.....	81 39.1	E. of N.
Tower on school 150 feet away.....	49 17.0	E. of S.
Spire of church 200 feet away.....	2 17.4	W. of S.

*Portland, Cumberland County.*—The station of 1906 on Western Promenade was reoccupied, but as it is not longer suitable for magnetic observations a new station was

established in Evergreen Cemetery, about 3 miles northwest of the city hall. The station is among the trees at the northwest corner of the old part of the cemetery. It is about 40 feet southwest of the southwest end of the lower pond, 137 feet northwest from the center of Northern Avenue, and 95 feet northeast from the center of Valley Avenue in the cemetery. It is 59 feet southeast of the southeast corner of a frame building used as a tool and store house. The station is marked by a gray granite stone 8 by 8 by 30 inches, bearing a bronze disk dated 1919 on its top. The stone was left projecting 6 inches above ground. The following true bearings were determined:

Near edge of base of Arthur Cleasby monument, 250 feet away (mark).....	20	47.3	E. of S.
Letter I in Lincoln on Lincoln C. Daniels monument, 200 feet away.....	16	57.3	E. of S.
Center of chimney on house one-half mile away across railroad.....	43	19.8	E. of N.
Tip on railroad water tank one-half mile away.....	48	37.8	E. of N.
Tip of Higgins and Graffam monument 250 feet away.....	24	35.5	E. of S.

## MARYLAND.

*Oakland, Garrett County.*—The station established in 1897 and last occupied in 1916 was reoccupied. It is 40.2 feet west-northwest from the southwest corner of the new high-school building, 80.7 feet southwest from the northwest corner, and about 35 feet from the walks along the south and west sides of the grounds. The station is marked by a granite post 7 by 7 inches and lettered S. M. 1897. This stone was buried about one foot underground when the yard was graded, so a second stone was set immediately over the other. It is of Bedford limestone, 3 by 4 by 10 inches. There is a meridian stone 82.5 feet due north of the station and another on the hillside about one-half mile to the north. The latter is obscured, however, by the house of John Davis. The following true bearings were determined in 1916 and 1919:

Southeast gable of Commercial Hotel.....	46	39.8	W. of N.
Apex of tower on grammar school.....	37	40.1	W. of N.
South gable of Dr. Howel's residence.....	11	31.2	W. of N.
Center of chimney on John Davis's house (mark) one-half mile away.....	0	14.2	W. of N.
South corner of new courthouse.....	47	06.1	W. of S.

## MASSACHUSETTS.

*Newburyport, Essex County.*—The station of 1916 was reoccupied. It is on the west side of Plum Island, about two-thirds of a mile south of the small car barn of the electric car line. It lies between the road and a small river near some sand hills, 176.5 feet northwest of the northwest corner of the veranda of Meadowview Cottage and 75 feet from the river. A telephone pole stands 230 feet to the east. The station is marked by a bronze disk set in the top of a granite post, 7 by 7 by 30 inches, projecting 10 inches above the ground. The following true bearings were determined in 1916 and 1919:

Pinnacle on Plum Island Light (mark).....	13	44.2	W. of N.
Butler's "Toothpick".....	21	07.3	W. of N.
Congregational Church spire (Oldtown).....	74	30.0	W. of N.
Gable of red cottage, one-fourth mile south.....	13	01.0	E. of S.
Center of brick chimney at electric-light plant.....	60	12.0	W. of N.

*Worcester, Worcester County.*—The station of 1898 was reoccupied. It is on the larger of the two small islands in the Salisbury Pond of the Institute Park, just north of the Worcester Polytechnic Institute. The point is marked with a granite post 4½ feet long, projecting 8 inches. The following true bearings were determined from the meridian line:

Church spire (Congregational) just to right of pavilion.....	29	49.6	E. of S.
West edge of brick chimney near middle of high building at institute.....	5	58.6	W. of S.
Center of small window in highest part of Bancroft Tower.....	75	19.9	W. of S.
Center of large brick stack at American Steel & Wire Co.....	72	00.2	E. of S.
Low steeple just to left of Light Plant high brick stacks.....	56	03.1	E. of S.

A new building has been constructed between the meridian stones since 1898, but the meridian has been carefully marked by a black-and-white disk just above one of the windows at the southeast corner of the building.

## MICHIGAN.

*Detroit, Wayne County.*—The station of 1907 was reoccupied. It is on the southeastern shore of Belle Isle, about 200 yards west of the lighthouse. It is marked by a blue limestone post, originally 8 inches square, sunk flush with the surface, lettered U. S. C. & G. S., and having a cross in the center. The north and south edges of the stone have been crushed so that the letters no longer show. This stone is about 45 feet from the shore and 60 feet from the edge of the paved driveway. A clump of horse-chestnuts stands between the stone and the driveway. The station is 18.7 feet southwest of one horse-chestnut tree, and 48.0 feet south-southeast of another larger one. The following true bearings were determined in 1910 and 1919:

Point on top of lighthouse.....	77	26.0	E. of N.
Dormer window on large house with pillars (Canadian side).....	10	17.0	E. of S.
East dormer window on brick house (Canadian side).....	4	48.6	W. of S.
Brick chimney at Ford Motor Works (Canadian side).....	65	22.6	W. of S.

*Kalamazoo, Kalamazoo County.*—The station of 1907 on the southern edge of the grounds of Kalamazoo College, about  $1\frac{1}{2}$  miles southwest of the center of the town, was reoccupied. It is about 528 feet west of Bowen Hall, 12 feet north of the edge of a steep bank down to Lovell Street, on the south side of the grounds, and about 426 feet southwest of a brick dwelling, which is the most western building on the grounds. It is marked by a Bedford limestone post 5 by 7 by 32 inches, projecting about 7 inches above the ground and lettered U. S. C. & G. S., 1907. The location of the stone is known to the college authorities. The following true bearings were determined in 1910 and 1919:

Center of highest cupola at asylum.....	4	59.8	W. of S.
Center of large tower at asylum.....	10	41.3	W. of S.
Flagstaff on cupola at normal school.....	52	35.1	E. of S.
Center of brick smokestack at normal school.....	49	41.2	E. of S.

## MISSISSIPPI.

*Jackson, Hinds County.*—The station of 1915 was reoccupied. It is about 2 miles north from the Capitol, on the grounds of the Millsaps College. The station is on the south side of Observatory Hill, about 300 feet south of the observatory and 224.5 feet east of the fence along the street. The station is marked by a limestone post, 6 inches square, projecting 3 inches above the ground. A hole in the top marks the center. The station is known to the authorities of the college. The following true bearings were determined in 1910 and 1919:

East wall of new brick building at college 1,000 feet away.....	14	29.4	E. of S.
East edge of chimney on same building.....	10	23.0	E. of S.
Center of cement smokestack at Asylum for Deaf and Dumb.....	56	08.0	W. of S.
Northeast edge, under eaves of building at orphanage 300 feet away..	62	32.2	W. of N.
Base of rod on cupola of orphanage main building.....	40	06.4	W. of N.

*Meridian, Lauderdale County.*—The station of 1915 was reoccupied. It is about 2 miles from the town, on the grounds of the State Asylum for the Insane. It is about 150 feet south of the walk leading to the front of the main building and 260 feet from the southeast corner of this building. The station is marked by a stone post 6 inches square projecting 3 inches above the surface of the ground. The following true bearings were determined in 1910 and 1919:

Lower south edge of main building.....	81 18.0 W. of S.
Flagstaff on dome of main building (base).....	58 55.2 W. of N.
Ball on dome of building farthest north.....	22 43.8 W. of N.
Outermost point of east gable on building north of main building..	30 31.2 W. of N.

*Wiggins, Stone County.*—The station is in the southeast corner of the courthouse grounds, about 1,000 feet southeast from the depot. It is 38.7 feet from the south fence, 14.4 feet west of the line of the east fence, 91.5 feet southeast from the southeast corner of the courthouse, 126.0 feet southeast from the southwest corner of the courthouse, and 120.7 feet east of the northeast corner of the jail. The station is marked by a piece of concrete 4 by 5 by 16 inches, set down about 4 inches below the surface of the ground. A small cross and hole in the top is the center. A half brick was buried just above the concrete marker, and was at the surface of the ground. The following true bearings were determined:

Steeple on small frame church three-eighths mile away (mark).....	14 00.3 W. of S.
Steeple on small frame church three-eighths mile away.....	42 01.2 W. of S.
Center of chimney at west end of depot building.....	56 21.6 W. of N.
West gable on Methodist Episcopal Church.....	56 58.3 E. of N.
Tiptop of water tank at mill one-half mile away.....	70 20.9 E. of S.

## NEW HAMPSHIRE.

*Bradford, Merrimack County.*—Observations were made about one-half mile southeast of the depot in a field belonging to F. B. Gould which lies just in the rear of his house and extends over to a road about 500 feet east of the house. The point occupied was about 75 feet southwest from the center of this road along the east side of the field, and about 90 feet south-southwest from an old apple tree, and was just across the road from a small house which sets near the road. The following true bearings were determined:

Chimney on house one-half mile away (mark).....	19 00.0 W. of S.
Center of nearer, lower chimney on F. B. Gould's house.....	83 20.1 W. of S.
Gable of house on hill one-eighth mile away.....	3 31.1 E. of N.

*Claremont Junction, Sullivan County.*—Observations were made on the small farm of Mrs. R. M. Pike, which is about one-half mile southwest of the Claremont Junction depot, along the wagon road. The station was in the west yard, 78 feet from the northwest corner of the barn and 44 feet from the center of the road in front. The station was not permanently marked. The following true bearings were determined:

Cupola on Moody's barn three-fourths mile away (mark).....	60 12.0 E. of S.
Center of chimney on Ainsworth's house one-eighth mile away.....	80 05.2 W. of S.
Flagpole on ridge three-eighths mile away.....	27 24.3 W. of N.
Center of chimney on Mrs. Ferninsky's house, 500 feet away.....	24 15.6 E. of N.

*Contoocook, Merrimack County.*—Observations were made in the fairgrounds, about five-eighths mile northwest of the depot. The station is in the west central part of the race-track oval, 47 feet southeast of the inside fence about the track and 93 feet

northeast of the east corner of the judges' stand, which is in the oval. The station was not marked. The following true bearing was determined:

Cupola on barn three-eighths mile away (mark)..... 8 17.8 W. of S.

*Danbury, Merrimack County.*—Observations were made in the cemetery, which is about one-eighth mile northeast of the depot. The point occupied was near the middle of the cemetery, 54 feet directly east of a large tombstone marked "Sergent" on the east side, 86 feet from the west fence about the cemetery, and about 140 feet from the south fence. This station was not permanently marked. The following true bearings were determined:

Spire of Congregational Church, one-fourth mile away (mark)..... 7 31.3 E. of S.  
Center of rear chimney on schoolhouse just west of frame church... 38 49.2 W. of S.  
Near gable on Rest View Cottage one-half mile away..... 59 09.3 W. of S.  
Center of chimney on Mr. Sargeant's house 800 feet away..... 0 33.2 E. of N.

*Hanover, Grafton County.*—The station of 1905 was reoccupied. It is on the hillside near the highest and northern part of the golf grounds of the Hanover Country Club near No. 3 putting green. A cherry tree is 72 feet from the station, bearing  $26\frac{1}{2}^{\circ}$  west of north. A pine tree (the northeast one of two adjacent pines) nearly in line with the cherry tree, is 104 feet away. The last elm tree on the south end of the row along the road bears  $56^{\circ} 6'$  east of south. The station is marked by a marble post 6 by 6 by 50 inches, projecting 1 foot above the ground and lettered U. S. C. & G. S., 1905. The following true bearings have been determined:

Top of roof on Bartlett stone tower..... 2 55.2 W. of S.  
Wind vane on Dartmouth Hall..... 9 56.4 W. of S.  
Wind vane on college church..... 17 25.7 W. of S.  
Center of last (on north) elm tree along drive, 400 feet away..... 77 34.4 E. of N.  
West gable of barn on Foster place one-half mile away..... 53 37.6 E. of S.

*Hillsboro, Hillsboro County.*—Observations were made on the fairgrounds, about one-eighth mile east of the depot. The station was within the race-track oval, about 100 feet east of the southwest part of the track, 32 feet east of a large, natural boulder and about 75 feet south of the line made by the main-street road as it comes down to the fairgrounds. The following true bearings were determined:

Cupola on barn one-fourth mile away (mark)..... 1 25.9 W. of N.  
Near gable of house on hill 1 mile away..... 57 14.2 E. of S.  
Cupola on barn 500 feet away..... 28 41.0 W. of N.

*Windham Depot, Rockingham County.*—Observations were made in the orchard in the rear of Mrs. Horace Berry's old home, about one-fourth mile south of the railroad crossing. The station was about 88 feet from the northwest corner of the house, 115 feet from the northeast corner, and about 150 feet east of the road along the west side of the old orchard lot. The station was not marked.

#### NEW JERSEY.

*Trenton, Mercer County.*—The station of 1910 was reoccupied. It is on the front lawn of the grounds of the State Hospital for the Insane, about 400 feet southeast and in front of the main building. It is about 94 feet east of the large tulip tree in the center of the lawn, 61 feet about west-southwest of a maple tree near the pathway, and about 77 feet southwest of another maple tree near the pathway. The station is marked by a marble post 6 by 6 by 18 inches (unlettered), buried flush with the

ground, and having a hole in its center to mark the exact point. The following true bearings were determined:

	°	'	
Peak of central tower on main building.....	56	22.3	W. of N.
Peak of west tower on main building.....	80	08.9	W. of N.
Northeast gable of barn.....	37	20.4	E. of S.
Center of rosette on inside of northeast lintel bracket of door of new building, 300 feet away.....	2	35.1	W. of N.

## NEW YORK.

*Albany, Albany County.*—The station of 1912 was reoccupied. It is on a hill about 400 feet west of the Loudonville Road, in a field on the Van Renssalaer estate, in front of a farmhouse occupied by Joseph Disco and brother. The station is not marked, but is 8 feet from the base of a white marble post 8 by 8 inches, projecting 3 feet above the ground, in the direction of the west tower of the State Capitol. This post is Monument No. 36 of the old Albany city line. The station is 100 feet east of the driveway to the farmhouse. The following true bearings were determined:

	°	'	
West tower tip on Capitol building (mark).....	12	09.8	W. of S.
Center of tower on large, stone building in Troy.....	61	07.2	E. of N.
Center of window in tower on Cleveland residence.....	67	17.0	E. of S.
Spire on St. Joseph's Church.....	0	39.8	W. of S.
Tower of City Hall.....	6	20.8	W. of S.

*Buffalo, Erie County.*—The station of 1908 was reoccupied. It is on the parade grounds of Fort Porter in front of the main barracks and in the rear of the building known as the "Castle." The station is in the line connecting the middle of door 11 of the barracks and the northwest corner of the Castle. It is 84.2 feet from the board fence in the rear of the Castle and 47.8 feet west from the west edge of the cement walk leading from the Castle to the Fort Exchange door. The station is marked by a Bedford stone post 8 by 8 by 24 inches, sunk flush with the surface, lettered U. S. C. & G. S., and center marked with a cross. The following true bearings were determined in 1915 and 1919:

	°	'	
Southeast corner of brick wall of house Nos. 34 and 35 (mark).....	70	42.3	W. of S.
West edge of black standpipe on Canadian shore.....	63	51.3	W. of N.
Spire of Episcopal Church.....	20	08.0	E. of N.
Center of right-hand-most window in Episcopal Church.....	22	28.0	E. of N.

*Greenport, Suffolk County.*—The station of 1904 was reoccupied. It is in the northern part of the school grounds, just south of a row of six large trees extending east and west and almost in a line north of the back entrance of the school building. It is 18.8 feet southwest from a maple tree—the third from the east in the above row—18.5 feet southeast from a linden tree, the third from the west, 102.6 feet from a fence to the east, 64.1 feet from a fence to the west, 76 feet from a fence to the north, 200 feet from the northwest corner of the high-school building, and 208.5 feet from the northwest corner of the public-school building. The station is marked by a marble post 30 by 10 by 10 inches, sunk flush with the ground and marked U. S. C. & G. S., 1904. The following true bearings have been determined:

	°	'	
Tower on elementary school (flagpole).....	6	09.0	E. of S.
Northwest corner of stone border on primary building.....	29	03.2	W. of S.
Center of gable window in house one-eighth mile away.....	14	31.9	W. of N.
Spire on Presbyterian Church (approximately).....	23	22.3	E. of N.
Northeast corner of stone border on high-school building.....	37	30.6	E. of S.



*Ithaca, Tompkins County.*—The station established in 1916 was reoccupied. It is one-third mile north and one-half mile east of the old station, on a gravel knoll in the cow pasture north of the dairy barns and east of the heating plant of the College of Agriculture. The pasture contains several ridges. The station is located toward the west end of the first ridge north of the dairy barns. It is marked by a bronze disk set in the top of a cement block 12 by 12 by 30 inches projecting 4 inches above the ground. It is about 75 feet east of the west fence about the pasture. The following true bearings were determined in 1916 and 1919:

Flagpole on dairy barn (mark).....	26	59.9	E. of S.
North ventilator of animal husbandry building.....	32	33.7	W. of S.
Tower of Sage College.....	76	59.7	W. of S.
Tower of library building.....	86	50.2	W. of S.
North edge of north tower of ladies' dormitory.....	59	33.1	W. of N.

*Jamaica, Queens County.*—Observations were taken in the southwest part of Forest Park, about 2½ miles west of the depot at Jamaica. The point occupied was in the golf links about 230 feet west and up the hill from the seventeenth hole. The station is about 148 feet from the junction of two roads to the south, and about 88 feet north-east from the center of the road that continues on around to the west. The station is also about 65 feet west-southwest from the center of the old eighteenth tee. The station is marked by a large natural rock that has a flat portion, about 18 inches long and 8 inches wide, which is a little above the level of the ground. A rude cross was found cut on this rock, and this was used as the center. A rude U. S. was cut on this stone just south of the cross. The following true bearings were determined:

Knot hole 8 feet above ground in middle one of three trees 700 feet away (mark) .....	10	38.3	E. of N.
Center of base of nearest lamp-post across driveway, 600 feet away..	81	11.8	E. of S.
Center of base of farther lamp-post across driveway, 700 feet away..	88	46.0	E. of S.
Center of cross on large rock 180 feet south across and next to road- way.....	3	37.8	E. of S.
Fork of large, double, oak tree 180 feet north.....	9	01.3	E. of N.

*Mineola, Nassau County.*—Observations were made on the southeast part of the fairgrounds, about five-eighths mile southeast of the depot. The station is about 222 feet north of the south fence and 259 feet west of the east fence around the fairgrounds. It is about 65 feet south-southeast of the center of the outer race track. Just south of the station is a row of a few hard-maple trees. Two of these trees are about 1 foot in diameter and stand about 75 feet apart. The station is 91.9 feet northwest of one of these two trees, and 99.5 feet north-northeast of the other. The station is also 29.9 feet southeast of a large soft-maple tree which stands near the race track. The station is marked by a marble post 8 by 8 by 28 inches projecting about 1 inch above ground, with a bronze disk dated 1919 set in the top. The following true bearings were determined:

Spire of Catholic Church at Garden City (mark).....	31	28.7	W. of S.
Center of large, brick stack three-fourths mile away.....	68	16.9	W. of S.
Rod on city water tank.....	16	07.1	W. of N.
Tip of water tank one-half mile away.....	76	11.9	E. of N.
Tip of water tank 1 mile away.....	64	42.3	E. of S.

*Norwich, Chenango County.*—The station is in the Protestant cemetery, which is about 1 mile south of the center of town. It is 85.5 feet north-northwest of the north-west corner of the Mount Hope Chapel, at the intersection of two paths. It is 15.2 feet southeast of the southeast corner of the Robb monument, 29.1 feet east of the

southeast corner of the Andrews monument, and 14.7 feet northeast of the northeast corner of the nearer one of the two Phetteplace monuments. The station is marked by a marble stone 7 by 10 by 27 inches, with a bronze disk dated 1919 set in the top. The stone is set flush with the surface of the ground. The following true bearings were determined:

Baptist Church steeple (mark).....	0 19.5 W. of N.
Methodist Church steeple.....	2 05.6 E. of N.
Tower on chapel in cemetery.....	28 51.9 E. of S.
Letter I in Whitmore tomb.....	87 26.6 W. of S.
Brick chimney (center) at Pharmaceutical Works.....	7 38.6 W. of N.

*Riverhead, Suffolk County.*—Observations were made in the fairgrounds, about one-half mile north of the depot. The station is within the race-track oval a little north of the middle of the east side, about 600 feet southeast of the northern end of the oval. It is 89.4 feet west of the inside fence around the track, 19.1 feet west-southwest from an oak tree, 60.9 feet north-northwest from another oak tree and 94.8 feet southeast of a third oak tree. The station is marked by a marble post 8 by 8 by 28 inches projecting about 1 inch above the ground, with a bronze disk set in the top. The following true bearings were determined:

Flagpole on tower of main hall 600 feet away (mark).....	27 58.3 E. of S.
Tiptop of judge's stand 325 feet away.....	13 44.2 W. of S.
Cross on left-hand tower of Catholic Church.....	22 12.8 W. of S.
Center of gable windows of house one-eighth mile away.....	87 22.8 W. of S.
Center of doors in stone vault 300 feet away.....	76 23.5 E. of N.

*Rochester, Monroe County.*—The station of 1907 was reoccupied. It is in Highland Park, on a ridge about 1,000 feet northeast from the fountain of Mount Hope reservoir. A line from the center of the children's pavilion in the park to the center of the Duffy-McInnerney Block, at the corner of West Main and North Fitcher Streets, passes through the station, which is in a saddle of the ridge about 400 feet distant from the pavilion. A meridian line was established, and the stone at the north end of this line marks the station. The south stone is 9 paces north of the refreshment store at the pavilion. The two stones (park monuments), each 4 by 4 by 66 inches, were set flush with the ground. The north stone is roughly lettered U. S. C. & G. S. The following true bearings were determined in 1915 and 1919:

Dome on Powers Building (mark).....	17 36.1 W. of N.
Pole on Armory.....	21 38.6 E. of N.
Tip on center of children's pavilion.....	20 11.8 E. of S.
Tower on small brick church one-half mile away.....	25 13.5 E. of N.

*Utica, Oneida County.*—The station is in Roscoe Conkling Park, near the place where observations were made in 1912. It is on the hill overlooking the city, 148.2 feet east-northeast of the flagpole beside the Conkling monument, 80 feet northeast of the center of the road, and 127.2 feet north-northeast of a yellow, granite, survey stone. This stone is 57 feet from the iron cemetery fence. The station is marked by a Bedford limestone post 6 by 6 by 20 inches, with a bronze disk in the top, set flush with the surface of the ground. The following true bearings were determined:

Spire of church in front of gas tank (mark).....	30 00.3 E. of N.
Cross on spire of church (St. Agnes?).....	48 42.9 E. of N.
Cross on spire of church near Valley Mills.....	60 48.3 E. of N.
Center of doors on Sherman's tomb.....	25 34.0 W. of S.
Brick stack at Caproni Plant, 2 miles away.....	66 43.1 W. of N.

## OHIO.

*Cincinnati, Hamilton County.*—The station of 1916 was reoccupied. It is in Burnett Wood Park, near the east boundary, between Lakewood Avenue and Nixon Street. It is on the ridge rising from the middle of the west side of the lake, north-northwest of the park stables, about 250 feet south of the fork in the roads (measured from the south side of the road at the bottom of the hill), and in line with the upper or north-west side of the lake. It is 37.5 feet from the middle point of twin elm trees on the east and 29.5 feet from a prominent bur oak tree on the northwest. It is also 92.5 feet south-southeast of a prominent beech tree on the edge of the ridge and 95 feet south-southwest of another. The station is marked by a marble post 6 by 6 by 28 inches, with a bronze disk in the top, set flush with the ground. The following true bearings were determined in 1916:

Cupola on residence near north entrance to park (mark).....	7	16.1	E. of N.
Prominent, sharp, south gable on large house 300 yards away.....	46	48.6	E. of N.
South side of water tank at ice plant.....	50	43.5	E. of S.
Left-hand spire on St. George's Church.....	15	08.9	E. of S.
Right-hand-most east gable on large brick building one-third mile away.....	81	02.9	W. of N.

*McConnellsville, Morgan County.*—The old station of 1904 was within a couple of feet of the northwest corner of the new high-school building, and therefore no longer suitable for magnetic observations. A new station was established on the grounds of Charles H. Morris, about 800 feet up the hill and across Main Street, north-northwest from the old station, or about one-half mile north of the courthouse. The station is in the southwest part of his yard, about 14 feet west of the Weather Bureau rain gauge. It is 82.1 feet west-southwest from the southwest corner of the house, 65.3 feet west of a large maple tree, 73.3 feet northwest of an elm tree, and 55.2 feet north-northeast of another elm. The old marking post was used. It is a marble post 6 by 6 by 30 inches, lettered U. S. C. & G. S., 1904, and set with its top projecting 1 inch above the ground. In addition, a bronze disk, dated 1919, was set in the top of the post. The following true bearings were determined:

Near gable on brick house 400 feet away (mark).....	23	03.9	W. of S.
Right-hand edge of house 500 feet away.....	43	32.5	W. of S.
Center of oak tree on ridge one-half mile away.....	32	31.4	E. of N.
Near edge at base of brick house 400 feet away.....	62	25.4	E. of S.
Near edge at base of old brick school building.....	46	13.3	E. of S.

## PENNSYLVANIA.

*Easton, Northampton County.*—The station of 1910 was reoccupied. It is in the northwest part of the March athletic field of Lafayette College, 38 feet southeast of the concrete wall surrounding the field, 12 feet northwest of the outer edge of the running track, and 1 foot southwest of the continuation of one of the sides of the baseball diamond. The station is marked by a marble post 6 by 6 by 15 inches, lettered U. S. C. & G. S., and buried with its face flush with the ground. The following true bearings were determined in 1914 and 1919:

Tower of courthouse 1 mile away (mark).....	23	30.0	W. of S.
South college tower tip.....	36	44.1	E. of S.
Northwest gable of fraternity house.....	65	26.4	E. of N.
Colton Memorial Chapel tower.....	66	04.6	E. of S.
East edge of gatehouse at reservoir 1 mile away.....	9	20.0	E. of N.

*Harrisburg, Dauphin County.*—Observations were made in the playground in Island Park, about midway between the bridges of Harrisburg Bridge Co. and the

Cumberland Valley Railroad Co., not far from the stations of 1910 and 1914. The station is 396 feet northwest of the nearest face of the first pier of the railroad bridge to the right of the two piers with large cones in them. It is also 216.4 feet north-northwest of a sycamore tree, 167.6 feet north-northeast of a large black locust, and 240.3 feet east of the center of a five-trunked maple tree, all three near the river bank. The station is marked by a marble post 6 by 6 by 26 inches, set flush with the ground, and lettered U. S. C. S. on the faces on the pyramidal top. The following true bearings were determined:

Raised hand on statue at State Capitol (mark).....	8 47.7 E. of N.
Tower on courthouse.....	26 02.7 E. of N.
Tip of left-hand cone on Cumberland Valley Railroad bridge pier..	72 25.3 E. of S.
Water tank $2\frac{1}{2}$ miles away.....	39 26.5 E. of S.
Center of large brick stack at power plant across river.....	19 52.4 W. of S.

## RHODE ISLAND.

*Kingston, Washington County.*—The station of 1910 was reoccupied. It is on the grounds of the Rhode Island Agricultural College, on the open square south of Lippitt Hall. It is southwest of the intersection of the two concrete walks in the campus, 2.5 feet south of the near edge of the east and west walk, and 17.8 feet west of the north and south walk. It is 236.3 feet east of the northeast corner of the dormitory, and 175 feet southwest of the flagpole. The station is marked by a marble post 10 by 10 by 30 inches, set about 2 inches below the level of the ground, and lettered U. S. C. S. A one-half-inch hole in the center marks the exact spot. The following true bearings have been determined:

Center of keystone over door of Science Hall.....	1 42.4 E. of S.
Hole in meridian stone 290 feet away.....	0 02.6 W. of S.
Lightning rod on boarding hall.....	66 33.0 W. of S.
Cap on north tower on Davis Hall.....	82 51.6 W. of N.
Tip on silo at dairy barn.....	19 02.0 W. of N.

*Providence, Providence County.*—The station of 1910 was reoccupied. It is on city property on the grounds of the Sockanosset reservoir, about 5 miles (air line) southwest of City Hall. It is in a pasture south of the center of the reservoir, about 125 yards west from a house where the gatekeeper lives, and about 120 yards from the nearest wall of the reservoir. It is 36.4 feet from a wire fence on the north side and 47.1 feet due east of an oak tree. It is also 61.3 feet due west of an ash tree. A second stone marking a meridian line was set 251.7 feet due south of the station. This stone is 18.1 feet northeast of an ash tree and 188.7 feet from the south wall of a pasture. The stones are each 4 feet long, 12 inches square at bottom, and 6 inches square at top, set flush with the ground, and lettered U. S. C. S. A small hole  $1\frac{1}{2}$  inches deep marks the exact spot. The following true bearings were determined in 1910 and 1919:

Tower on main hall at Rhode Island School for Boys (mark).....	37 53.7 E. of S.
Center of stone over door at gatehouse, 200 feet away.....	18 28.6 E. of N.
Chapel tower tip at Sockanosset School.....	48 51.3 E. of S.

## TENNESSEE.

*Nashville, Davidson County.*—The station of 1915 was reoccupied. It is in the southwest part of Mount Olivet Cemetery, about 3 miles from the center of the city. It is 61 feet southwest from the S. D. Wade monument, 89.7 feet west-northwest from the Chas. C. Collins monument, 54 feet northwest from the Robert B. Lea tomb, and 96.8 feet northeast from a large white-oak tree across the driveway. The station is marked by a Bedford limestone post 5 by 8 by 30 inches, projecting about 2 inches above the ground and lettered U. S. C. & G. S. 1905. The following true bearings were determined in 1915 and 1919:

Flagpole on cupola at State Capitol.....	64	08.4	W. of N.
Gardiner monument, tip.....	54	39.0	W. of N.
Ensley monument, tip.....	35	49.7	E. of N.
Minor monument, tip.....	87	07.6	E. of N.
Tip of tower on building three-fourths mile away (mark).....	14	48.0	W. of S.

## VERMONT.

*Burlington, Chittenden County.*—The station of 1898 was reoccupied. It is the south end of the meridian line on the campus of the University of Vermont, in the rear of the buildings. It is marked by a granite post and is about 200 feet east-northeast of the northeast corner of the University gymnasium. The north stone is about 300 feet southeast of the southeast corner of the Engineering building and is 719.3 feet from the magnetic station and projects about 6 inches above the ground. The following true bearings were determined in 1910 and 1919:

Rod on cupola of college barn.....	35	34.7	E. of S.
Cupola tip on barn 600 feet away.....	30	00.2	W. of S.
Northeast corner of granite base of Williams Science Hall.....	52	15.1	W. of N.
Center of concrete transit base near southeast corner of Engineering building.....	17	22.3	W. of N.

*Cambridge Junction, Lamoille County.*—Observations were made in the field belonging to M. C. Leach, about one-eighth mile south of the railroad depot. The station is approximately 120 feet south of the rear fence of Mrs. Edith Manchester's yard and 350 feet northwest of Mr. Leach's house. It was not permanently marked. The following true bearings were determined:

West gable of barn three-fourths mile away (mark).....	30	24.7	E. of N.
Near edge of chimney on M. C. Leach's house.....	59	09.7	E. of S.
Near edge of chimney on Mr. Russel's house, 600 feet away.....	82	28.6	W. of N.
Rod on post-office building, 500 feet away.....	26	56.1	W. of N.
Center of chimney on Mrs. Edith Manchester's house.....	3	41.3	E. of N.

*Hardwick, Caledonia County.*—Observations were made over the stone at the northwest corner of lot M in the new city cemetery, which is about 1 mile southeast of the center of town on a high hill or ridge. The station is about 30 feet northwest of the George H. Kimball monument and about 60 feet from the fence along the northwest side of the cemetery. The following true bearings were determined:

Cupola on red barn three-fourths mile away (mark).....	44	11.1	E. of S.
North chimney (center) on house one-eighth mile away.....	60	12.2	W. of S.
Center of chimney on house one-fourth mile away.....	44	22.5	W. of N.
Near edge of base of Gifford monument, 175 feet away.....	71	56.3	E. of S.

*Rutland, Rutland County.*—The station of 1905 was reoccupied. It is on land of the city home for the poor, about  $1\frac{1}{2}$  miles east of the center of town. It is just south of the abandoned little graveyard on the hill east of the buildings. From the station northwest to the southwest corner of the graveyard fence is 47.9 feet; northeast to the southeast fence corner is 72 feet. The station is marked by a large, natural, white sandstone rock which protrudes above ground and is lettered U. S., 1905. The following true bearings were determined in 1910 and 1919:

Top of water tank tower $1\frac{3}{4}$ miles away.....	4	23.5	E. of N.
West gable of white farmhouse.....	80	11.8	E. of S.
North gable of barn three-fourths mile away (mark).....	7	06.9	W. of S.
North gable of large red barn one-half mile away.....	28	31.6	W. of S.
Highest east gable of city poorhouse.....	58	02.8	W. of S.

*St. Johnsbury, Caledonia County.*—The station of 1905 was reoccupied. It is in a pasture belonging to the E. & T. Fairbanks Co., on a sand hill south of the village and immediately south of the house and yard now (1919) owned by P. P. Ailes. The finial of a small tower on Mr. Fairbanks's house and the spire of St. Aloysius Church are in range with the station. To the corner of the fence around Mr. Ailes's yard is 145 feet, bearing  $8^{\circ} 51'$  east of north. The station is marked by a marble post 5 by 5 by 36 inches, projecting 1 inch above ground and lettered U. S. C. & G. S., 1905. The following true bearings were determined in 1910 and 1919:

Center of tower windows on Fairbanks house 600 feet away (mark).....	7 35.4 E. of N.
West gable of Flanigan house $1\frac{1}{2}$ miles away.....	26 45.6 E. of N.
Finial of tower on Gouthier's right-hand house, across river three-fourths mile away.....	36 05.5 E. of N.
Tower on Gibbon's house one-half mile away.....	58 08.6 E. of N.
Tower on little schoolhouse $1\frac{3}{4}$ mile away.....	48 34.0 W. of N.

*West Burke, Caledonia County.*—Observations were made in the southeast part of the public-school yard, at a point 20 feet from the east fence, 25 feet from the south fence, and about 70 feet southeast of the southeast corner of the main part of the school building. The station was not permanently marked. The following true bearings were determined:

Observation tower on Burke Mountain 5 miles away (mark).....	39 31.0 E. of S.
Center of chimney on house 400 feet away.....	24 25.7 E. of S.
Spire on church one-eighth mile away.....	33 08.9 W. of S.
Cupola on barn 400 feet away.....	83 45.5 W. of S.

#### WEST VIRGINIA.

*Berkeley Springs, Morgan County.*—Observations were made in the northern part of the cemetery, about 1 mile south-southwest from the depot and five-eighths mile south of the courthouse. The station is 83.9 feet from the fence along the northeast side of the cemetery, 137.6 feet from the fence along the northwest side, 125.8 feet north-northwest from the northernmost corner of the base of the Hunter obelisk monument, and 128.2 feet northwest from the northernmost corner of the base of the Ruppenthal monument. The station is marked by a marble post 6 by 6 by 16 inches set in cement in a  $2\frac{1}{2}$ -foot hole. A bronze disk dated 1919 is set in the top, which projects about 3 inches above the ground. The following true bearings were determined:

Near edge of large chimney on Perrin house on top of ridge.....	19 25.6 W. of N.
Near edge of large chimney on Pendleton house on hillside.....	11 49.7 W. of N.
Near gable of frame house 600 feet away.....	15 57.3 E. of N.
Tip on Oliver Kesecker monument.....	5 37.1 W. of S.
Center of chimney at tiptop of house 1,000 feet away.....	81 49.0 W. of N.

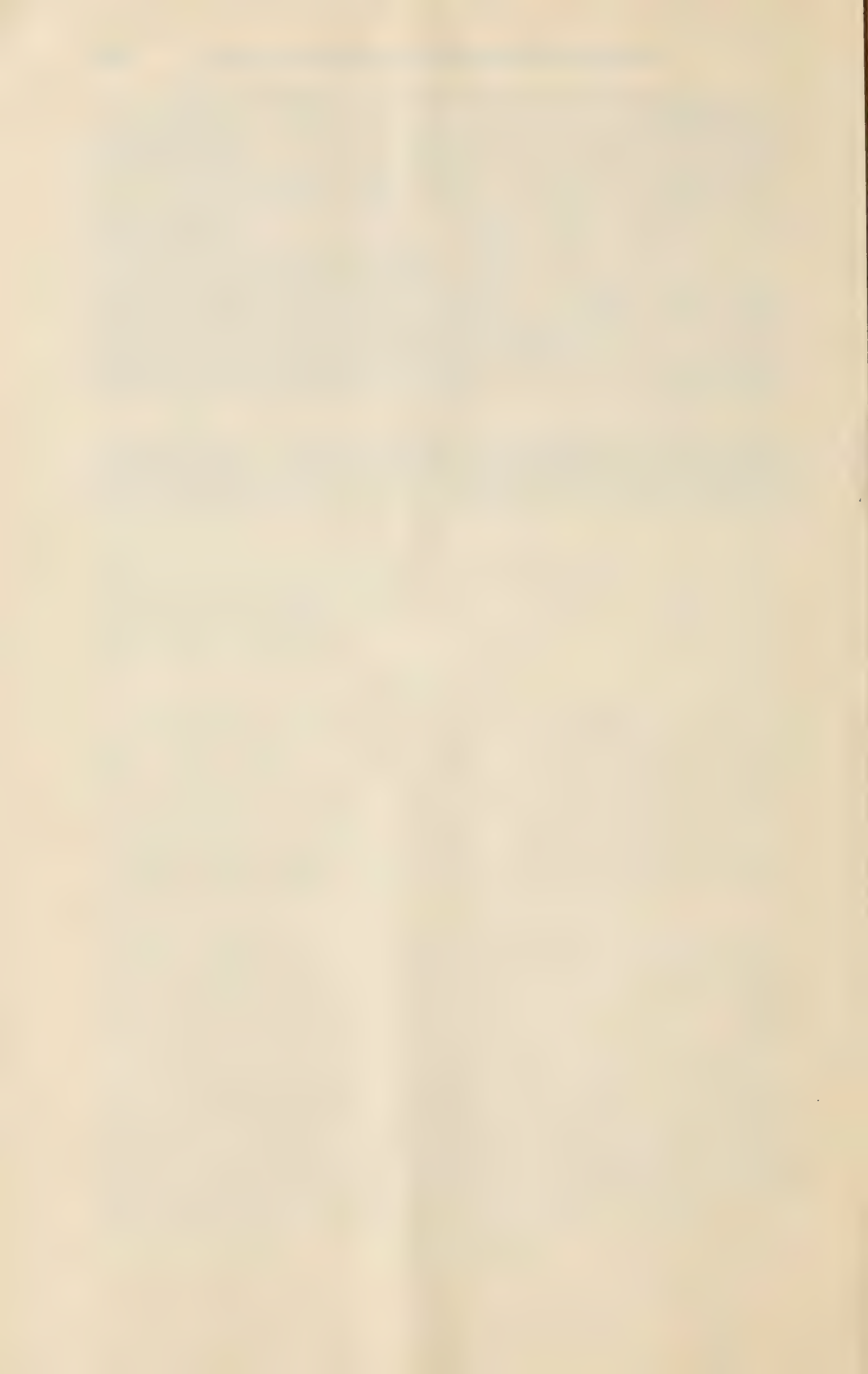
*Middlebourne, Tyler County.*—The station is in the southwest corner of the high-school grounds, about 700 feet west-southwest from the courthouse. It is 305.4 feet south-southwest of the southwest corner of the high-school building, 22.5 feet east of the west fence, and 80.7 feet north-northeast from an elm tree which stands just below the bank of Middle Island Creek. The station is marked by a pentagonal-shaped post of Bedford limestone 32 inches long, projecting 1 inch above the surface, with a bronze disk dated 1919 set in the top. The following true bearings were determined:

Near gable on E. T. Fetty's house, east of road, three-eighths mile away (mark).....	16 59.8	W. of S.
Cupola on M. H. Staley's house 600 feet away.....	31 43.8	W. of N.
Southwest brick edge of high-school building.....	24 17.6	E. of N.
Left-hand edge of brick tower on Methodist Episcopal Church three-eighths mile away.....	56 18.6	E. of N.
Cupola on courthouse, 700 feet away.....	73 45.2	E. of N.

*Parkersburg, Wood County.*—The station established in 1918 was reoccupied. It is in the city park, in a clump of trees northeast of the old grand stand and about 135 feet east of the old log house. It marks the north end of a meridian line 697 feet long, the south end being near the superintendent's house. Both ends of the meridian line are marked by heavy Cleveland sandstone posts set with their tops projecting 10 inches above the ground. The following true bearings were determined in 1919 by reference to the meridian line:

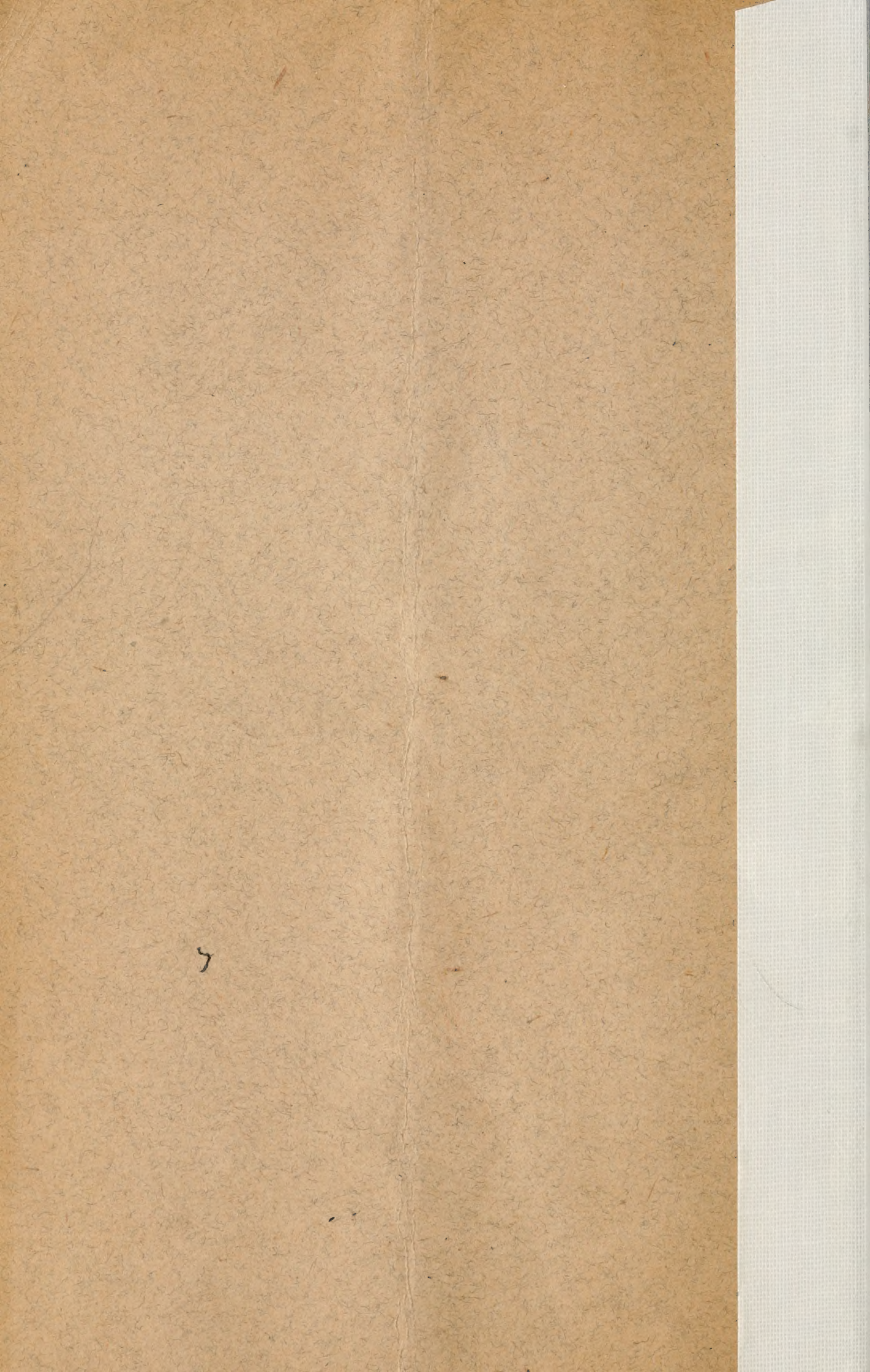
Tip of obelisk in cemetery one-fourth mile away.....	11 39.5	E. of N.
Near edge of chapel in cemetery one-fourth mile away (mark).....	20 14.0	E. of N.
North gable on house 700 feet away.....	69 29.7	E. of S.
Near (west) gable on house 700 feet away.....	60 47.8	E. of S.











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